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09/463,643 05/01/00 NAKAMURA

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EXAMINER

MM91/0919

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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/463,643

Applicant
Nakamura et al.

Examiner
William Baumeister

Art Unit
2815



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on Jul 17, 2001

2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 1-17 is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) 1-8 and 12-17 is/are rejected.

7) ☒ Claim(s) 9-11 is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on Apr 18, 2000 is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

- ☐ Certified copies of the priority documents have been received.
- ☐ Certified copies of the priority documents have been received in Application No. _____
- ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)

18) ☐ Interview Summary (PTO-413) Paper No(s). _____

16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

19) ☐ Notice of Informal Patent Application (PTO-152)

17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 5, 7, 8

20) ☐ Other:

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DETAILED ACTION

Drawings

1. The drawings are objected to because FIG 2 employs a plurality of horizontal shading lines to depict layer 23, the second n-contact layer. The specification discloses that the embodiment of FIG 2 does not employ a superlattice for the second layer, but rather a single second layer (See e.g., specification, page 28, example 8). However, the shading employed for single layer 23 of FIG 2 is the same as for superlattice layer 4 of FIG 1, rendering FIG 2 unclear as to whether a superlattice or a single layer is intended. Correction is required.

Claim Objections

2. Claims 1-6, 9 and 12-14 are objected to because of the following informalities:
- a. Claim 1, line 5 recites “dopes” [sic: doped].
 - b. Claim 1, line 6 and 7, reciting “a first (singular) and a second (singular) undoped nitride semiconductors (plural)...” is grammatically improper.
 - c. Claim 2, line 5 recites “AlGan” (N is lowercase).
 - d. Claim 9, line 2 recites “c,” [sic: cm]
 - e. Claim 12, line 5 recites “super super-lattice...”
 - f. Claim 14, line 2 recites “an active layer here [sic: where] electrons...”
 - g. Claim 14, line 5 recites “and ha s first surface... [sic: and has a first surface...]”

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h. Claim 14, line 6, reciting “a first (singular) and a second (singular) undoped nitride semiconductors (plural)...” is grammatically improper.

i. Claim 14, line 7 recites “fist” [sic: first].

Appropriate correction to these and any other errors not specifically mentioned is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 8-11, 13 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a. Claim 8 recites “at least either one of [the superlattice layers] is doped with Si.” Claim 8 depends from claim 7, and claim 7 sets forth that one layer of the superlattice is undoped. Thus, it is unclear whether claim 8 means that both layers may be doped or how *at least* either one of the layer (as opposed to “either one of the layers,” implying both) may be doped since one is undoped.

b. Claim 13 recites “further [sic: the] nitride semiconductor layer comprising said active layer is formed through GaN undoped with n-impurity on said n-type contact layer.” It is unclear whether the claim intends to mean (1) that the active layer is composed of undoped GaN

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or (2) that the device further comprises an undoped GaN layer interposed between the nitride layer comprising said active layer and said n-type contact layer. One skilled in the art would not be apprised of the scope of the claim.

c. Claim 14 recites the limitation "said...layer of GaN" in line 4. There is insufficient antecedent basis for this limitation ("of GaN") in the claim.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

6. Claims 14-16 are rejected under 35 U.S.C. 102(e) as being anticipated by Rudaz '029 (supplied in applicant's IDS #7). Rudaz discloses AlGaInN emitters having three n-type contact layers, composed of e.g., GaN:Si (col. 3, lines 8-). The first is undoped or lightly doped, the second is highly doped and the third is doped lower than that of the second (see e.g., col. 2, lines 42-56). The emitters may be formed on sapphire substrates with GaN buffers (BACKGROUND).

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7. Claims 1-5, 14, 15 and 17 is rejected under 35 U.S.C. 102(e) as being anticipated by JP 09116130 (submitted in IDS #5). JP '130 discloses a III-N light emitter having an n-contact layer composed of undoped GaN (buffer) 8, Si:GaN 5 and undoped GaN 4. The doping concentration of layer 5 is disclosed as being $1 \times 10^{19}/\text{cm}^3$ (paragraph [0032]), hence the region will also have the resistivity set forth in claims 4 and 5.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Insofar as definite, claims 7, 8 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Official Notice of that which was well known to those of ordinary skill in the art at the time of the invention in view of Bruno et al. '604. It was well known to those of ordinary skill in the art at the time of the invention to form GaN-based p-i-n light emitters on sapphire substrates with the use of various types of buffers such as GaN or AlN. The only remaining issue is whether it was known to employ an undoped/doped superlattice in the n-type contact region of the LED, as set forth in these claims.

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a. Bruno discloses modulation-doped GaN-based superlattices on sapphire substrates with GaN buffers wherein the GaN wells are undoped and the AlGaN barriers are doped for the purpose of providing a contact for electro-optic devices with increased electron mobility. It would have been obvious to one of ordinary skill in the art at the time of the invention to employ this modulation-doped superlattice conductor/contact structure into the n-type contact region of a conventional GaN-based p-i-n light emitter for the purpose of obtaining high electron mobility in this region as taught by Bruno.

b. While Bruno does not appear to disclose what types of dopants are employed in the barrier layers, it is either inherently implied or at least obvious that they must be n-type dopants since (1) the purpose is to increase electron--as opposed to hole--mobility; and (2) the alternative embodiment for achieving similar results employs n-type dopants (col. 4, lines 25-30).

c. In further regard to claim 8, while the reference does not state what specific dopant is being used, it would have been obvious to one of ordinary skill in the art at the time of the invention to specifically employ Si since Si is one of the most common materials used for n-doping GaN-based materials.

d. Claim 13 is rejected under the first possible interpretation set forth in the 112-2nd rejections set forth hereinabove.

10. Claims 7, 8, 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rudaz '029 as applied to the claims above, and further in view of Bruno et al. '604 as applied to

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the claims above. As was explained above, Rudaz discloses a III-N light emitter having a compound n-layer, and discloses that additional sublayers may be added such that the composition, thickness and doping level of each layer accommodates a desired electrical characteristic or physical property for the device (col. 4, lines 1-). Rudaz does not specifically disclose the inclusion of a modulation-doped superlattice. As explained above, Bruno discloses a III-N modulation-doped superlattice which increases the region's electron mobility. It would have been obvious to one of ordinary skill in the art at the time of the invention to employ the superlattice of Bruno in the second sublayer 16B of Rudaz for the purpose of decreasing the region's electrical resistivity as taught by both of these references.

11. Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rudaz '029 as applied to the claims above, and further in view of JP '130 as applied to the claims above. Rudaz discloses all of the limitations of the claims except for the second undoped layer. Rather, Rudaz more generally states that the third sublayer 16C is lesser doped than the second sublayer. JP '130 discloses a III-N emitter wherein an undoped GaN layer 4 is interposed between the n-type contact 5 and the active layer. Assuming arguendo that "lesser doped" does not expressly include "undoped," it would nonetheless have been obvious to one of ordinary skill in the art at the time of the invention to leave the third sublayer 16C of Rudaz undoped for the purpose of reducing crystalline defects as taught by JP '130.

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Double Patenting

12. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

13. Claims 1, 15 and 17 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 8 of copending Application No. 09/534,503. Although the conflicting claims are not identical, they are not patentably distinct from each other because the present claims are broader than claim 8 of the '503 application since claim 8 possesses, *inter alia*, all of the limitations of the recited claims of the present application. It would have been obvious to one of ordinary skill in the art at the time of the invention to make a III-N light emitter having at least the three-layer n-contact structure since it has been held that the omission of an element and its function in a combination where the remaining elements perform the same function as before involves only routine skill in the art. *In re Karlson*, 136 USPQ 184.

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This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Allowable Subject Matter

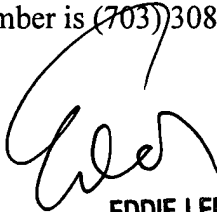
14. Claim 9-11 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. A search of the relevant art failed to disclose or suggest a superlattice in the device as claimed having a carrier concentration or resistivity as set forth in these claims.

INFORMATION ON HOW TO CONTACT THE USPTO

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister**, at **(703) 306-9165**. The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

B. William Baumeister

September 15, 2001


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